Activity Report 2012

Section Contracts and Grants with Industry

<p style="text-align: center; color: red;">**ARIC Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. STMicroelectronics CIFRE PhD Grant

Jingyan Jourdan-Lu was supported by a CIFRE PhD grant (from March 2009 to September 2012) from STMicroelectronics (Compilation Expertise Center, Grenoble) on the theme of floating-point arithmetic code generation and specialization for embedded processors. Advisors: Claude-Pierre Jeannerod and Jean-Michel Muller (AriC), Christophe Monat (STMicroelectronics). A contract between STMicroelectronics and Inria (duration: 36 months; amount: 36,000 euros; signature: fall 2010) aimed at supporting the developments done in the context of this PhD, defended 2012/11/15.

7.1.2. Kalray CIFRE PhD Grant

Nicolas Brunie is supported by a CIFRE PhD grant (from 15/04/2011 to 14/04/2014) from Kalray. Its purpose is the study of a tightly-coupled reconfigurable accelerator to be embedded in the Kalray multicore processor. Advisors: Florent de Dinechin (Arénaire) and B. de Dinechin (Kalray). The support contract between Kalray and Inria amounts to 76,000 euros on three years.

7.1.3. Intel Donation

Intel is making a donation of 20,000$ to AriC to support research around the automatic construction of libm functions.

<p style="text-align:center;color:red;font-weight:bold;">COMPSYS Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Mediacom Project with STMicroelectronics

Participants: Benoit Boissinot, Florian Brandner, Quentin Colombet, Alain Darte, Fabrice Rastello.

This contract has started in September 2009 as part of the funding mechanism Nano2012. This is the continuation of the successful previous project Sceptre with STMicroelectronics, which ended in December 2009. Mediacom concerned both aggressive optimizations and the application of the previously-developed techniques to JIT compilation. The project ended this year. Quentin Colombet, whose PhD was funded by this project, defended his PhD in December 2012 [1].

7.2. Creation of the Zettice Start-Up

Participants: Christophe Alias, Alexandru Plesco [Compsys/Zettice].

Following his PhD, Alexandru Plesco initiated a start-up on high-level synthesis for FPGAs, named Zettice, and based on the use and extension of tools/techniques developed in Compsys (for high-level code transformations) and Arénaire (for the development of pipelined operators). The results described in Sections 5.7 , 5.8 , 5.9 , and 6.4 are directly linked to this effort.

The incubation of Zettice is supported by Crealys, the "Région Rhône-Alpes", and Inria: Alexandru Plesco is "ingénieur technologie and innovation" (ITI) since October 2011. Zettice should be created around April 2013. Christophe Alias is in charge of the scientific collaboration between Compsys and Zettice.

7.3. ManyCoreLabs with Kalray

Compsys is part of ManyCoreLabs, an academic/industrial project, coordinated by Kalray, a multi-core french company. The project is funded by a "Investissement d'Avenir"/BGLE ("Briques génériques du logiciel embarqué") grant. The goal of this project is to help the Kalray company, based on a collaboration with several partners, to become the European leader of the market of many-core chips for embedded systems. Industrial partners of this project include Bull, CAPS Entreprise, Digigram, Thales, Renault. Academic partners include CEA, Inria (Parkas and Compsys teams), VERIMAG.

CONVECS Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

Participants: Hubert Garavel, Abderahman Kriouile, Radu Mateescu, Wendelin Serwe.

Abderahman Kriouile is supported by a CIFRE PhD grant (from March 2012 to March 2015) from STMicroelectronics (Grenoble) on the verification of cache coherency in systems on chip, under the supervision of Grégory Faux and Massimo Zendri (STMicroelectronics), Radu Mateescu and Wendelin Serwe (CONVECS).

POP ART Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- With ST Microelectronics: CIFRE contract for the PhD of Vagelis Bebelis. This work is described in Section 6.4.1 .

<p align="center" style="color:red">BIPOP Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. CIFRE THESIS

7.1.1. *Schneider Electric*

Participants: Vincent Acary, Narendra Akadkhar, Bernard Brogliato.

This is a long-term relationship with this company, starting in 2001 with the post-doc of V. Acary. A PhD thesis funded by SE started in December 2012 (Narendra Akadkhar), co-supervised by V. Acary and B. Brogliato, and by M. Abadie (SE). The topic is about simulation of circuit breakers with mechanical play, and multiple impacts with friction modelling.

7.1.2. *ANSYS*

Participants: Vincent Acary, Mounia Haddouni, Bernard Brogliato.

This collaboration started in May 2012 with the CIFRE thesis of M. Haddouni. The topic is about numerical simulation of multibody systems with unilateral contact, impacts and friction.

7.1.3. *ALDEBARAN*

Participants: Pierre-Brice Wieber, Jory Lafaye.

This collaboration started in March 2012 with the CIFRE thesis of J. Lafaye. The topic is biped walking control schemes in dynamic environments.

7.1.4. *ADEPT*

Participants: Pierre-Brice Wieber, Saed Al Homsi.

This collaboration started in September 2012 with the CIFRE thesis of S. Al Homsi. The topic is fast reactive motion generation for manipulator robots.

7.2. Other contracts

7.2.1. *L'OREAL*

Participant: Florence Bertails-Descoubes.

L'OREAL: Contrat d'étude with L'Oréal, starting in December 2012 until April 2013 .

MISTIS Project-Team (section vide)

NANO-D Team (section vide)

NECS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. KARRUS start-up

The NeCS team is continuing its activity in road traffic modeling and control. The expected scientific contribution of NeCS in this field concerns the development of new estimation prediction and identification algorithms based on the measurements collected through sensor networks installed on freeways. The team study also the problems of time-to destination and control algorithms for ramp metering. The team is currently setting up a consortium with local authorities involved in traffic management to build a demonstrator called GTL for Grenoble Traffic Lab. One target of this activity is to transfer part of the developed technology to a start-up named Karrus and led by Denis Jacquet (http://www.karrus.fr/). The start-up was created in January 2010.

7.2. Bilateral Grants with Industry

7.2.1. AIRBUS

Accompanying PhD contract with AIRBUS in the framework of the CIFRE PhD grant of P. Andrianiaina. The goal of this PhD thesis is to study flexible implementation methods for real-time controllers, aimed at reducing the conservatism induced by the current approach purely based on worst case considerations.

7.2.2. IFPEN

Accompanying PhD contract with IFPEN (IFP Energies Nouvelles), in the framework of the PhD grant of A. Ben Khaled. The thesis explores new architectures and flexible scheduling methods to enhance the trade-off between the integration accuracy and the simulation speed of distributed real-time (hardware-in-the-loop) simulators, in particular in the framework of automotive power-trains.

Accompanying PhD contract with IFPEN (IFP Energies Nouvelles), in the framework of the PhD grant of Giovanni de Nunzio. The thesis explores eco-driving for comunicating vehicles in urban environment.

<p style="text-align:center">**OPALE Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

ArcelorMittal-Inria industrial contract n. 5013 : Opale started a thorough collaboration in optimal design of high performance steel with the mentioned world leader industrial. The aim of the collaboration is to develop and study new and efficient tools dedicated to multicriteria shape optimization of structures which undergo large non-linear elasto-plastic deformations.

The present contract has three years duration and funds the Ph.D. thesis of Aalae Benki and Research financial support.

BAMBOO Project-Team (section vide)

BEAGLE Team (section vide)

DRACULA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The MIREV project, on the "Modeling of the Immune Response to support Efficient Vaccine development", submitted in 2011 to the BioAster IRT, is still in the selection process. Partners include: Sanofi-Pasteur, Altrabio, Antagene, The Cosmo Company, INSERM-I2V and Dracula Team.

6. Bilateral Contracts and Grants with Industry

6.1. Genostar

Participant: François Rechenmann.

Genostar, an Inria start-up created in 2004, provides bioinformatics solutions for the comparative analysis of bacterial genomes, proteomes and metabolomes. Genostar's software suite performs the annotation of sets of genomic sequences, *i.e.*, the identification of the coding sequences and other features, followed by the prediction of the functions of the gene products. The modules which make up the software suite were originally developed within the Genostar consortium and the HELIX project team at Inria Grenoble - Rhône-Alpes. The software suite also includes the modeling and simulation tool GNA developed by members of IBIS (Section 4.1). Genostar offers a comprehensive service line-up that spans genome sequencing, read assembly, annotation, and comparison. Genostar thus works with trusted subcontractors, each specialized in state-of-the-art sequencing technologies. François Rechenmann is scientific consultant of the company. For more information, see http://www.genostar.com.

6.2. BGene

Participant: Johannes Geiselmann.

BGene is a start-up company of Université Joseph Fourier in the field of DNA engineering. BGene proposes efficient and custom-made modifications of bacterial genomes, leaving no scars or antibiotics resistance genes. The company has know-how and expertise at all stages of the development process, including the *in-silico* design of a desired construction, the choice of the right genetic tools, and the delivery of the finished product. Former IBIS-member Caroline Ranquet and Johannes Geiselmann are co-founders of BGene, together with Marie-Gabrielle Jouan (Floralis, Université Joseph Fourier).

MOISE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

- A 4-year contract named ReDICE (Re Deep Inside Computer Experiments) with EDF, CEA, IRSN, RENAULT, IFP on the thematic computer experiments
- A 3-year contract with CEA Cadarache related to Simon Nanty's PhD.
- A 3-year contract with EDF: project MeCSiCo (coupling methods for the simulation of river flows): see 4.4
- A 3-year contract with ADEME on the thematic "Stochastic Downscaling Method": see 5.4 .

NUMED Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

SANOFI Pasteur: second contrat on vaccine degradation study.

7.2. Bilateral Contracts with Industry

SERVIER: four years frame contract.

STEEP Exploratory Action

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

EADS Astrium   We have been sub-contractors of EADS Astrium in several national and international application-oriented projects. This activity is related to the previous research in computer vision of some team members.

7.2. Bilateral Grants with Industry

ARTELIA   We have agreed on a CIFRE scheme for a PhD on the topic: Material flow and environmental impact analyses at local scales, from labor pools to regions. We are currently waiting for the validation by ANRT.

AVALON Team (section vide)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- A bilateral contract has been signed between the DANTE Inria team and ACT750 to formalize their collaboration in the context of churn prediction.

- A bilateral contract has been signed between the DANTE Inria team and KRDS to formalize their collaboration in the context of Facebook marketing / cascade analysis.

- A bilateral contract has been signed between the DANTE Inria team and HiKoB to formalize their collaboration in the context of the Equipex FIT (Futur Internet of Things) FIt is one of 52 winning projects in the Equipex research grant program. It will set up a competitive and innovative experimental facility that brings France to the forefront of Future Internet research. FIT benefits from 5.8 euros million grant from the French government Running from 22.02.11 – 31.12.2019. The main ambition is to create a first-class facility to promote experimentally driven research and to facilitate the emergence of the Internet of the future.

7.2. Inria Alcatel-Lucent Bell Labs joint laboratory

Participants: Isabelle Guérin-Lassous, Paulo Gonçalves, Thomas Begin, Éric Fleury, Doreid Ammar, Mohamad Jaber.

Traffic awareness, Flow analysis, Flow scheduling, Sampling, Flow-based routing

Former RESO team participated to the ADR (Action de Recherche/Research Action) "Semantic Networking" (SEM- NET), one of the three ADRs of the Inria ALCATEL-LUCENT BELL LABS joint laboratory. This ADR started on January 1st 2008 and formally ended in October 2012. I. Guérin Lassous and L. Noirie are the respective coordinator for Inria and for ALCATEL-LUCENT of the ADR SEMNET.

In 2013 the research axes of the Joint Lab will be renewed and a new one entitled "Network Science" will involve the participation of the research team DANTE.

<p style="text-align:center; color:red">MESCAL Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. Real-Time-At-Work

RealTimeAtWork.com is a startup from Inria Lorraine created in December 2007. Bruno Gaujal is a scientific partner and a founding member of the startup. Its main target is to provide software tools for solving real time constraints in embedded systems, particularly for superposition of periodic flows. Such flows are typical in automotive and avionics industries who are the privileged potential users of the technologies developed by http://www.RealTimeAtWork.com.

7.1.2. ADR Selfnets with Alcatel

Selfnets is an ADR (action de recherche) of the common laboratory between Inria and Alcatel Lucent Bell Labs. Bruno Gaujal is co-leading the action with Vincent Rocca. Selfnets is mainly concerned with self-optimizing wireless networks (Wifi, 3G, LTE). Eight Inria teams are participating in Selfnets. As for MESCAL, we mainly work on recent mobile equipment (e.g. using the norm IEEE 802.21) can freely switch between different technologies (vertical handover). This allows for some flexibility in resource assignment and, consequently, increases the potential throughput allocated to each user. We develop and analyze fully distributed algorithms based on evolutionary games that exploit the benefits of vertical handover by finding fair and efficient user-network association schemes.

7.2. Grants with Industry

7.2.1. CIFRE contracts with STMicroelectronics

- Kiril Georgiev has done his PhD with STMicroelectronics on distributed file systems and defended in Dec. 2012.

<div style="text-align:center">**MOAIS Project-Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- Contract with EDF (2010-2013). High performance scientific visualization. Fund 1 postdoc and 1 PhD. Partners: Inria (MOAIS and EVASION), EDF R&D

- HiPeComp, NANO 2008-2012 contract with ST-MicroElectronics. The project HiPeCoMP (High Performance Components for MPSoC) consists in the development an coupling of: on the one hand, wait-free scheduling techniques (pre-partitioning and mapping, on-line work stealing) of component based multimedia applications on MPSoC architectures; and on the other hand, monitoring, debug and performance software tools for the programming of MPSoC with provable performances.

- CEA: Contract with CEA (2012): Europlexus Parallelization with KAAPI. Partners: Inria Rhônes-Alpes and CEA Saclay.

PLANETE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

Industrial contract with Alcatel Lucent - Bell Labs   (2008-2012):

> The goal of this study is the use of AL-FEC techniques in broadcasting systems and in particular on the optimization of FEC strategies for wireless communications. Two persons are working in the context of this contract: Ferdaouss Mattoussi works on the design, analysis and optimization of a Generalized LDPC AL-FEC scheme, and Rodrigue Imad work focuses on Unequal Erasure Protection capabilities (UEP) and file bundle protection systems.

ROMA Team (section vide)

SARDES Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Grants with Industry

- PhD grant Quentin Sabah, funded by STMicroelectronics.
- PhD grant Xavier Etchevers, funded by Orange Labs.

<p align="center">**SOCRATE Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Industry

Socrate has strong collaboration with Orange Labs (point to point collaboration) and Alcatel Lucent through the Inria-ALU common lab and the Green Touch initiative. Socrate also works in collaboration with Siradel, a french worldwide company working on wireless system simulations, Sigfox a french young compagny deploying the first cellular network operator dedicated to M2M and IoT, and HIKOB a start-up originated from the Citi laboratory providing sensor networks solutions. A bilateral cooperation supports the PhD of Laurent Maviel, and Siradel is a member of the Ecoscell ANR project in which Socrate is involved.

Socrate started in September 2011 a strong bilateral cooperation with the Euromedia group about Body Area Networks in which Hervé Parvery, Guillaume Villemaud and Jean-Marie Gorce are involved and the project supports the thesis of Matthieu Lauzier.

7.2. National Actions

7.2.1. Equipex FIT- Future Internet of Things (2011-..., 1.064 k€)

The FIT projet is a national equipex (*equipement d'excellence*), headed by the Lip6 laboratory. As a member of Inria, Socrate is in charge of the development of an Experimental Cognitive Radio platform that should be used as test-bed for SDR terminals and cognitive radio experiments. This should be operational in 2013 for a duration of 7 years. To give a quick view, the user will have a way to configure and program through Internet several SDR platforms (MIMO, SISO, and baseband processing nodes).

7.2.2. ANR - ECOSCELLS - Efficient Cooperating Small Cells (2009-2012, 242 keuros)

Ecoscells is a national initiative (ANR) which aims at developing algorithms and solutions to ease Small Cells Network deployment. Theoretical studies will provide models for understanding the impact of radio channels, and permit the definition of new algorithms exploiting a full diversity (user, spatial, interferences, etc.) of such networks. The novelty of the project is not to consider the interference as a drawback anymore, but to exploit it in order to offer an optimal resource utilization. The algorithms will be based on most recent developments in distributed algorithms, game theory, reinforcement learning. Architecture and algorithms for the back-hauling network will also be proposed.

7.2.3. ANR - Cormoran - "Cooperative and Mobile Wireless Body Area Networks for Group Navigation" (2012-2015, 150 keuros)

Cormoran project targets to figure out innovative communication functionalities and radiolocation algorithms that could benefit from inter/intra-BAN cooperation. More precisely, the idea is to enable accurate nodes/body location, as well as Quality of Service management and communications reliability (from the protocol point of view), while coping with inter-BAN coexistence, low power constraints and complying with the IEEE 802.15.6 standard. The proposed solutions will be evaluated in realistic applicative scenarios, hence necessitating the development of adapted simulation tools and real-life experiments based on hardware platforms. For this sake, Cormoran will follow an original approach, mixing theoretical work (e.g. modelling activities, algorithms and cross-layer PHY/MAC/NWK design) with more practical aspects (e.g. channel and antennas measurement campaigns, algorithms interfacing with real platforms, demonstrations).

7.2.4. FUI ECONHOME - "Energy efficient home networking" (2010-2014, 309 keuros)

The project aims at reducing the energy consumption of the home (multimedia) data networks, while maintaining the quality requirements for heterogeneous services and flows, and preserving, or even enhancing the overall system performance. the equipments under concern are residential gateways, set-top-boxes , PLC modules, Wifi extenders, NAS. The user equipment, such as smartphones, tablets or PCs are not concerned. The approach relies on combining both individual equipments IC and system level protocols that have to be eco-designed.

7.2.5. ADR Selfnet - "Self Optimization Networking" (2008-2012, 258 keuros)

This action is a part of the common lab of Inria and Alcatel Lucent Bell Labs. This action groups several team of Inria with Alcatel teams and adresses different aspects of Self Networking: distributed algorithms, energy efficiency, mobility. Virgile Garcia has finished is PhD on distributed power management in cellular networks and

7.3. Actions Funded by the EC

7.3.1. Projet iPLAN - FP7-PEOPLE-IAPP-2008 (2009-2012, 440 keuros)

(Indoor Planning) (2009-2012, 440k€)
iPlan is an FP7 project of the FP7-People-IAPP-2008 call. The iPlan consortium is made of the Ranplan Company, the Citi Laboratory and the University of Bedfordshire and proposes the study of Indoor planning and optimization models and tools. The aim is to develop fast and accurate radio propagation models, investigate various issues arising from the use of femtocells, develop an automatic indoor radio network planning and optimization and facilitate knowledge integration and transfer between project partners, to enable cross-fertilization between radio propagation modeling, wireless communications, operations research, computing, and software engineering.

7.4. Theses, Internships

7.4.1. Theses

7.4.1.1. Theses defended in 2012

Virgile Garcia: "*Resource sharing optimisation for self-organized cellular networks*", PhD thesis from INSA LYON, Inria/Alcatel-Lucent grant,30/04/2012.

7.4.1.2. Theses in preparation

Mickael Dardaillon: "*Virtual machine for the cognitive radio*", Rhône-Alpes grant, since 10/2011.

Cengis Hasan: "*Optimization of resource allocation for small cells networks*", Orange labs grant, since 01/2010.

Paul Ferrand: "*Cooperative communications in BANET*", MENRT, since 10/2009.

Arturo Jimenez Guizar: "*Cooperative communications in Body Area Networks*", ANR Cormoran grant, since 09/2012.

Matthieu Lauzier: "*Design and evaluation of information gathering systems for dense mobile wireless sensor networks*", CIFRE/Euromedia, since 09/2011.

Meiling Luo: "*Fast and accurate radio propagation models for radio network planning*", MENRT grant, since 01/2010.

Laurent Maviel: "*Wireless heterogeneous networks dynamic planning in urban and indoor non-stationary environments*", CIFRE grant with SIRADEL, since 11/2009.

Baher Mawlawi: CEA grant, since 09/2012.

Matthieu Vallerian: "*Radio Logicielle pour réseau de capteurs*", CIFRE/Orange, since 09/2012.

Zhaowu Zhan: "*Full-Duplex Multimode MIMO wireless communications*", CSC/China grant with , since 9/2012.

7.4.2. Participation in thesis Committees

Jean-Marie Gorce:

- Examinateur au jury d'Habilitation à diriger les recherches de Olivier Berder: "Systèmes multi-antennes et efficacité énergétique des réseaux de capteurs sans fil" (nov. 2012, Univ. Rennes1)
- Examinateur au jury d'Habilitation à diriger les recherches de Fabien Mieyeville: "Méthodes de conception hiérarchique de systèmes hétérogènes multi-physiques communicants" (Ecole Centrale Lyon, mai. 2012)
- Rapporteur de la thèse de Guillaume Viennot "Utilisation de techniques d'imagerie de synthèse pour le calcul de la propagation des champs électromagnétiques" (Université Limoges, dec. 2012)
- Rapporteur de la thèse de Hussein Kdouh: "Application of Wireless Technologies to Alarm and MonitoringSystem on Board Ships" (INSA Rennes, dec. 2012).
- Rapporteur de la thèse de Vinh Tran: "Energy efficient cooperative relay protocols for wireless sensor networks" (Université Rennes 1, dec. 2012).
- Rapporteur de la thèse de Mustapha Dakkak: "Indoor geo-location : static and dynamic geo-location of mobile terminals in Indoor environments" (Université Paris-Est, nov. 2012).
- Rapporteur de la thèse de Yougourta Benfattoum: "Network coding for quality of service in wireless multi-hop networks" (Université Paris-Sud, nov. 2012).
- Rapporteur de la thèse de Getachew Rediateb: "Cross-layer optimization for next generation WiFi" (INSA Rennes, oct. 2012).
- Rapporteur de la thèse de Dora Ben Cheikh Battikh "Outage probability formulas for cellular networks: contributions for MIMO, CoMP and time reversal features" (Telecoms Paris Tech, juillet 2012).
- Directeur de thèse de Virgile Garcia: "Opportunistic radio resource sharing for next-gen cellular networks" (Insa-Lyon, 29 Mars 212).

Tanguy Risset:

- Président de jury de la thèse d'Antoine Floch, le 8 juin 2012 (U. Rennes 1/ENS Cachan)
- Examinateur pour le jury de thèse de Naeem Abbas, 22 mai 2012 (U. Rennes 1/ENS Cachan - IRISA).
- Directeur d'Habilitation à Diriger les recherches de Marine Minier, le 31 mai 2012 (U Lyon1/Insa-Lyon)

7.4.3. Internships

- Pierre BRUNISHOLZ, "OFDM decoding on a Virtex 6 FPGA"
- Fayçal AIT-AOUDIA "OFDM decoding on a Virtex 6 FPGA"
- Moemen CHERNI "Smart radio pour réseau de capteurs"
- Borja DE RIVA SOLLA "Etude des techniques de sous-échantillonnage pour la radio logicielle"
- Thibaut VUILLEMIN "Performance analysis for /dev/random"
- Egea Pierrick "Mise en place d'une plateforme experimental d'evolution de charges dans les systemes d'exploitation"
- Jimenez-Guzar Arturo "PHY layer network coding"
- Richelmy Marion "Algorithmes pour les self-optimized networks"
- Vasselin Virginie "Algorithmes pour les self-optimised networks"

7.5. Teaching

- Tanguy Risset and Jean-Marie Gorce and are professor in the Telecommunications department of Insa Lyon.

- Claire Goursaud is associate professor in the Telecommunications department of Insa Lyon.

- Guillaume Salagnac and Kevin Marquet are associate professors in the Computer Science department of Insa Lyon.

- Guillaume Villemaud and Florin Hutu are associate professor in the Electrical Engineering department of Insa Lyon.

- Nikolai Lebedev is associate professor in the engineering school in Chemistry, Physics and Electronics, Lyon.

- Tanguy Risset has been the vice-head of the Telecommunications department of Insa Lyon until september 2012.

- Tanguy Risset is the responsible for the Networking program of the Master Mastria from University of Lyon.

- Jean-Marie Gorce is the responsible for the Telecommunications program of the future Master EEAP from University of Lyon.

- Guillaume Villemaud is responsible for international relations in the Electrical engineering département of Insa Lyon

<p style="text-align:center">**URBANET Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Two bilateral collaborations are running since 2009 with Orange Labs, and another one since 2008. These collaborations include the supervision of Ph.D. students into a common research program (heterogeneity in wireless sensor networks, resiliency and security of routing protocols, quality of service support of WSN). These three collaborations ended in 2012.

- Two short-term bilateral collaborations, also with Orange Labs, were pursued in 2012: a 4 months project in quality of service in WSN (joint supervision of a master student), and a 2 months project on the SensORLab testbed, deployed in Orange Labs (Meylan).

- A new bilateral collaboration with Orange started in November 2012. This CRE includes the supervision of a CIFRE thesis about multi-topology routing protocol and service level agreement for wireless sensor networks.

- One short-term bilateral collaborations with Thalès was done during 4 months, as a preliminary research project for a Ph.D. student. Unfortunately, no candidate with solid/strong background applied for this position yet. This project should start in 2013.

<p style="text-align: center; color: red">E-MOTION Project-Team</p>

6. Bilateral Contracts and Grants with Industry

6.1. Contracts with Industry

6.1.1. *Toyota Motors Europe*

[Feb 2006 - Feb 2009] [Dec 2010 - Dec 2014]

The contract with Toyota Motors Europe is a joint collaboration involving Toyota Motors Europe, Inria and ProBayes. It follows a first successful short term collaboration with Toyota in 2005.

This contract aims at developing innovative technologies in the context of automotive safety. The idea is to improve road safety in driving situations by equipping vehicles with the technology to model on the fly the dynamic environment, to sense and identify potentially dangerous traffic participants or road obstacles, and to evaluate the collision risk. The sensing is performed using sensors commonly used in automotive applications such as cameras and lidar.

This collaboration has been extended for 4 years and Toyota provides us with an experimental vehicle Lexus equipped with various sensing and control capabilities. Several additional connected technical contracts have been signed also.

6.1.2. *Renault*

[Jan 2010 - Feb 2013]

This contract is linked to the PhD Thesis of Stephanie Lefèvre. The objective is to develop technologies for collaborative driving as part of a Driving Assistance Systems for improving car safety. Both vehicle perception and communications are considered in the scope of this study. An additional short-term contract (3 months) has also been signed in november 2012.

6.1.3. *PROTEUS*

[November 2009 - October 2013]

PROTEUS ("Robotic Platform to facilitate transfer between Industries and academics") is an ANR project involving 6 industrial and 7 academic partners. This projects aims to develop a software platform which helps to share methods and softwares between academics and industries in the field of mobile robotics.

The project works on three main aspects :

- Specification of different scenarios and its associated formalism.
- Definition of a domain specific language (DSL) to specify and execute the given scenarios.
- Setting up 4 robotic challenges to evaluate the capacity and the usability of the platform.

The contribution of *e-Motion* to PROTEUS is first to provide its expertise on mobile robotics to develop the DSL and next to provide a simulation environment with its platform "CycabTK".

Juan Lahera-Perez has been recruited as engineer to work on this project with Amaury Nègre.

6.1.4. *Delta Drone*

[9 May 2012 - 9 November 2012]

This is a collaboration between our lab and the company Delta Drone. The goal of this collaboration is the exploitation of our competences in visual inertial navigation in order to make a drone able to perform autonomous navigation in GPS denied environment. This would have a strong impact on many civilian applications (e.g., surveillance, rescue mission, building inspection, etc.) During 2012, our effort has been focused on the first important step which must be accomplished in order to perform any task: the hovering. To this regard, we introduced a new method to localize a micro aerial vehicle (MAV) in GPS denied environments and without the usage of any known pattern. This makes possible to perform hovering in an unknown and GPS denied environment. The method has successfully been implemented on the platform available in our lab. This is a *Pelican* from *Ascending Technologies* equipped with an Intel Atom processor board (*1.6 GHz, 1 GB RAM*).

6.1.5. IRT-Nano Perfect (2012-2014, and 2015-2017)

Perfect is a project supported by ANR in the scope of the IRT (Technological Research Institute) Nano-electronic driven by the CEA (Nuclear Energy Agency). The partners of the project are the CEA-LETI LIALP laboratory, ST-Microelectronics and Inria. The goal of this project is to propose integrated solutions for "Embeeded Bayesian Perception for dynamic environments" and to develop integrated open platforms. During the first phase of the project (2012-2014), the focus is on the domain of transportation (both vehicle and infrastructure); health and smart home sectors will also be considered in the second phase (2015-2017).

6.1.6. FUI Permobile (2013-2015) – submitted

Permobile is a project submitted to the 15th FUI call for project. The consortium of the project puts together research labs, large industrial partners and local small and medium companies. The objective of Permobile is to create electronic solutions (both hardware and software) for an embedded system for mobile perception in dynamic environments. This system is intended to anticipate potential collisions which may occur for the mobile platform (car, bus, aerial drone. . .).

The starting point is the current perception system developed in the e-Motion team for automotive applications, which is currently implemented on a standard PC (CPU+GPU) architecture. Permobile intends to improve the perception capability and to reduce the size, cost and electrical consumption of the system through the integration on the mobile technologies. A first stage consists in using current mobile technologies, while the second stage proposes to develop an innovative mobile board incorporating multiple mobile CPU/GPU processors. Demonstrators based on real mobile platforms (bus and aerial drone) will be developed to assess the realism and the efficiency of the approach developed in the project.

The partners of the project include both experts in software (Inria, Probayes), hardware (CEA LETI, Calao systems, ST-Ericsson), and final users of the technology (Delta-Drone, SEMITAG).

6.2. National Initiatives

6.2.1. Inria Large Initiative Scale PAL (Personaly Assisted Living

[Nov 2009 - Nov 2013]

The objective of this project is to create a research infrastructure that will enable experiments with technologies for improving the quality of life for persons who have suffered a loss of autonomy through age, illness or accident. In particular, the project seeks to enable development of technologies that can provide services for elderly and fragile persons, as well as their immediate family, caregivers and social groups.

The Inria Project-Teams (IPT) participating in this Large-scale initiative action Personally Assisted Living (LSIA Pal) propose to work together to develop technologies and services to improve the autonomy and quality of life for elderly and fragile persons. Most of the associated project groups already address issues related to enhancing autonomy and quality of life within their work programs. This goal of this program is to unite these groups around an experimental infrastructure, designed to enable collaborative experimentation.

Working with elderly and fragile to develop new technologies currently poses a number of difficult challenges for Inria research groups. Firstly, elderly people cannot be classified as a single homogeneous group with a single behavior. Their disabilities may be classified as not just physical or cognitive, motor or sensory, but can also be classified as either chronic or temporary. Moreover, this population is unaccustomed to new technologies, and can suffer from both cognitive and social inhibitions when confronted with new technologies. None-the-less, progress in this area has enormous potential for social and financial impact for both the beneficiaries and their immediate family circle.

The spectrum of possible actions in the field of elderly assistance is large. We propose to focus on challenges that have been determined through meetings with field experts (medical experts, public health responsible, sociologists, user associations...). We have grouped these challenges into four themes: monitoring services, mobility aids, transfer and medical rehabilitation, social interaction services. These themes correspond to the scientific projects and expectations of associated Inria projects. The safety of people, restoring their functions in daily life and promoting social cohesion are all core motivations for this initiative.

e-Motion concentrates his work on mobility aids using the wheelchair.

6.3. European Initiatives

6.3.1. *Major European Organizations with which you have followed Collaborations*

Department of Electrical & Computer Engineering: Univeristy of Thrace, Xanthi (GREECE)

Subject: 3D coverage based on Stochastic Optimization algorithms

BlueBotics: BlueBotics Company, Lausane (Switzerland)

Subjet: Implementation of self-calibration strategies for wheeled robots and SLAM algorithms for industrial purposes

Autonomous System laboratory: ETHZ, Zurich (Switzerland)

Subjet: Vision and IMU data Fusion for 3D navigation in GPS denied environment.

6.4. International Initiatives

6.4.1. *"ict-PAMM"*

[September 2011- September 2013]
ict-PAMM is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministery of Foreign Affair and Inria. This project aims at conducting common research activities in the areas of robotic mobile service and robotic assistance of human in different contexts of human life. French partners are Inria-emotion from Grenoble, Inria-IMARA from Rocquencourt and Institut Blaise Pascal from Clermont-Ferrand. Asian Partners are IRA-Lab from Taiwan, ISRC-SKKU from Suwon in Korea, ITS-Lab from Kumamoto in Japan and Mica Institute from Hanoi in Vietnam.

6.4.2. *"Predimap"*

[September 2011- September 2013]
Predimap is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministery of Foreign Affair and Inria. This project aims at conducting common research activities in the area of perception in road environment. The main objective is the simultaneous use of local perception and Geograpical Information Systems (GIS) in order to reach a global improvement in understanding road environment. Thus the research topics included in the project are: local perception, precise localization, map-matching and understanding of the traffic scenes. French partners are Inria-emotion from Grenoble, Heudiasyc team from CNRS/UTC, and Matis team from IGN. Foreign partners are Peking University and Shanghai Jiao Tong University in China, CSIS lab from Tokyo University in Japan and AIT Geoinformatics Center in Thailand.

6.4.3. *"PRETIV"*

[November 2011- October 2014]

Multimodal Perception and REasoning for Transnational Intelligent Vehicles" (PRETIV) is a three-year ANR project accepted in the framework of the Blanc International II Programme with participants from France (e-Motion of Inria, Heudiasyc of CNRS, PSA Peugeot Citroen DRIA in Velizy) and China (Peking University, PSA Peugeot Citroen Technical Center in Shanghai). The project aims at developing of an online multimodal perception system for a vehicle and offline reasoning methods, dealing with incompleteness and uncertainties in the models and sensor data, as well as at conducting experiments in typical traffic scenarios in France and China to create an open comparative dataset for traffic scene understanding. The perception system will incorporate vehicle localization, mapping of static environmental objects, detecting and tracking of dynamic objects in probabilistic frameworks through multimodal sensing data and knowledge fusion. The reasoning methods are based on sensor data to learn semantics, activity and interaction patterns (vehicle - other objects, vehicle - infrastructure) to be used as a priori information to devise effective online perception algorithms toward situation awareness. The comparative dataset will contain experimental data of typical traffic scenarios with ground-truth, which will be used to learn country-specific traffic semantics and it will be open to the public.

6.4.4. *Visits of International Scientists*

In 2011, M. Perrollaz went to Ohio Northern University for a short term research contract. From this collaboration, two papers were published in 2012: [24] and [33].

In 2012, Dimitrios Kanoulas, PhD Student at Northeastern University (Boston, USA) came at Inria for 4 months, within the framework of the REUSSI program.

6.4.4.1. *Internship*

Procopio Silveira-Stein, phD at LAR (Laboratório de Automação e Robótica) at UA (Universidade de Aveiro) is in our team for november 2011 to july 2012.

6.4.5. *Participation In International Programs*

Submission of a international program with Taiwan called I-Rice. Partners for this proposition of an international center are IRA-lab (Taiwan university), LAAS, Inria and UPMC. Topics are related to Cognitive Systems and Robotics. Project under evaluation (hearing step).

Submission of an ANR Blanc GeoProb in collaboration with the spinoff Probayes (Mexico). Project on complementary list.

EXMO Project-Team (section vide)

<p style="text-align:center">**IMAGINE Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts and Grants with Industry

7.1.1. EADS - Idealization of components for structural mechanics (06/2011 - 06/2014)

Participants: Jean-Claude Léon, Stefanie Hahmann.

Cifre PhD in partnership with EADS IW to generate the shape of mechanical components through dimensional reduction operations as needed for mechanical simulations, e.g. transformations from volume bodies to shells or plates forming surface models, usually non-manifold ones. The topic addressed covers also the shape detail removal process that takes place during the successive phases where subsets of the initial shape are idealized. Mechanical criteria are taken into account that interact with the dimensional reductions and the detail removal processes. The goal is to define the transformation operators such that a large range of mechanical components can be processed as automatically and robustly as possible. Some results from the homology computation topic may be used in the present context. An ongoing publication should address the description of the various stages of a component shape transformation in the context of assemblies.

7.1.2. HAPTIHAND technology transfer project (Inria-HAPTION-Arts et Métiers ParisTech) (10/2012-12/2013)

Participant: Jean-Claude Léon.

The objective is to transfer a device, named HandNavigator, that has been developed in collaboration with Arts et Métiers ParisTech/Institut Image, as add on to the 6D Virtuose haptic device developed by HAPTION. The purpose of the HandNavigator is to monitor the movement of a virtual hand at a relatively detailed scale (movements of fingers and phalanxes), in order to create precise interactions with virtual objects. This includes monitoring the whole Virtuose 6D arm and the HandNavigator in a virtual environment, for typical applications of maintenance simulation and virtual assembly in industry. The project covers the creation of an API coupled to physical engine to generate and monitor a realistic and intuitive use of the entire device, a research study about the optimal use of the device as well as a project management task.

LEAR Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Start-up Milpix

Participants: Hervé Jégou [Inria Rennes], Cordelia Schmid.

In 2007, the start-up company MILPIX has been created by a former PhD student of the LEAR team, Christopher Bourez. The start-up exploits the technology developed by the LEAR team. Its focus is on large-scale indexing of images for industrial applications. Two software libraries were licensed to the start-up: BIGIMBAZ and OBSIDIAN.

7.2. MBDA Aerospatiale

Participants: Albert Gordo, Michael Guerzhoy, Frédéric Jurie [University of Caen], Cordelia Schmid.

The collaboration with the Aerospatiale section of MBDA has been on-going for several years: MBDA has funded the PhD of Yves Dufurnaud (1999-2001), a study summarizing the state-of-the-art on recognition (2004), a one year transfer contract on matching and tracking (11/2005-11/2006) as well as the PhD of Hedi Harzallah (2007-2010). In September 2010 started a new three-year contract on object localization and pose estimation.

7.3. MSR-Inria joint lab: scientific image and video mining

Participants: Anoop Cherian, Adrien Gaidon, Zaid Harchaoui, Yang Hua, Cordelia Schmid.

This collaborative project, starting September 2008, brings together the WILLOW and LEAR project-teams with researchers at Microsoft Research Cambridge and elsewhere. It builds on several ideas articulated in the "2020 Science" report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project focuses on fundamental computer science research in computer vision and machine learning, and its application to archeology, cultural heritage preservation, environmental science, and sociology. Adrien Gaidon was funded by this project.

7.4. Xerox Research Center Europe

Participants: Zeynep Akata, Zaid Harchaoui, Thomas Mensink, Cordelia Schmid, Jakob Verbeek.

In a collaborative project with Xerox, staring October 2009, we work on cross-modal information retrieval. The challenge is to perform information retrieval and document classification in databases that contain documents in different modalities, such as texts, images, or videos, and documents that contain a combination of these. The PhD student Thomas Mensink was supported by a CIFRE grant obtained from the ANRT for the period 10/09 – 09/12. A second three-year collaborative project on large scale visual recognition started in 2011. The PhD student Zeynep Akata is supported by a CIFRE grant obtained from the ANRT for the period 01/11 – 01/14.

7.5. Technosens

Participants: Guillaume Fortier, Cordelia Schmid, Jakob Verbeek.

In October 2010 we started an 18 month collaboration with Technosens (a start-up based in Grenoble) in applying robust face recognition for application in personalized user interfaces. During 18 months an engineer financed by Inria's technology transfer program, implemented and evaluated our face recognition system on Technosens hardware. Additional development aimed at dealing with hard real-world conditions.

MAVERICK Team (section vide)

MORPHEO Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Technicolor

A three year collaboration with Technicolor has started in 2011. The objective of this collaboration is to consider the capture and the interpretation of complex dynamic scenes in uncontrolled environments. A co-supervised PhD (Abdelaziz Djelouah) has started on this topic [6].

PERCEPTION Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contract with Samsung Electronics

We continued a collaboration with the Samsung Advanced Institute of Technology (SAIT), Seoul, South Korea. Within this project we develop a methodology able to combine data from several types of visual sensors (2D high-definition color cameras and 3D range cameras) in order to reconstruct, in real-time, an indoor scene without any constraints in terms of background, illumination conditions, etc. A software package was successfully installed in December 2012 at Samsung.

<p style="text-align:center; color:red;">**PRIMA Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CAPEE - plateforme Capteur d'Activité et de Présence pour l'Efficacité Enérgétique

Participants: James Crowley [correspondant], Lucas Nacsa, Amaury Nègre, Lukas Rummelhard.

In Cooperation with local PME Novazion, Inria has worked with and Schneider Electric to create a research plafform for activity recognition for Smart Energy Systems. This system integrates information from multiple environmental sensor to detect and track people in indoor environments. Copies of this system has been installed at Schneider Electric Homes research group in Grenoble and in the Smart Spaces lab at Inria Montbonnot.

An associated software, named MultiSensor activity tracker, integrates information from multiple environmental sensors to keep track of the location and activity of people in a smart environment. This model is designed to be used by a home energy broker that would work in conjunction with a smart grid to manage the energy consumption of home appliances, balancing the needs of inhabitants with opportunities for savings offered by electricity rates. This database will also be used for by advisor services that will offer advice to inhabitants on the consequences to energy consumption and energy cost that could potentially result from changes to lifestyle or home energy use.

WAM Project-Team (section vide)